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EXACTECH, INC
2320 NW 66th Court
Gainesville, FL 32653
USA

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352.378.2617

FSN Ref: 2021-01-29-03-AUG22	FSCA Ref: 2021-01-29-03-AUG22

Date: XX August 2022

Urgent Field Safety Notice

RECALL
IMPORTANT UPDATE REGARDING
EXACTECH GXL & CONVENTIONAL ACETABULAR LINERS FOR NOVATION, ACUMATCH, AND MCS SYSTEMS

For Attention of:

[redacted]
Exactech France
Parc Ariane
Bâtiment 2
42 avenue Ariane
33700 Mérignac, France
Phone : +33564371560
Fax : +33556967395
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Urgent Field Safety Notice
RECALL

IMPORTANT UPDATE REGARDING EXACTECH GXL & CONVENTIONAL ACETABULAR LINERS FOR MCS, ACUMATCH & NOVATION SYSTEMS

1. Information on Affected Devices	
1.	1. Device Type(s)
	EXACTECH GXL AND CONVENTIONAL ACETABULAR LINERS FOR NOVATION, ACUMATCH, AND MCS SYSTEMS
1.	2. Commercial name(s)
	GXL Connexions, MCS, Acumatch and Novation Acetabular Polyéthylène Liner
1.	3. Unique Device Identifier(s) (UDI-DI)
	See Attachment 1
1.	4. Primary clinical purpose of device(s)
	All Exactech Hip Systems are indicated for use in skeletally mature individuals undergoing primary surgery for hip replacement due to osteoarthritis, rheumatoid arthritis, osteonecrosis, post-traumatic degenerative problems of the hip, and for treatment of proximal femoral fractures where prosthetic replacement is determined by the surgeon as the preferred treatment. Components of Exactech Hip Systems are also potentially indicated for ankylosing spondylitis, congenital hip dysplasia, revision of failed previous reconstructions where sufficient bone stock is present, and to restore mobility resulting from previous fusion. • Cemented femoral stems and cemented acetabular cups are intended for cemented fixation only. • Press-fit femoral stems and acetabular cups are intended for press-fit fixation. • Femoral heads and endoprostheses are intended for use in cemented and press-fit applications.
1.	5. Device Model/Catalogue/part number(s)
	See Attachment 1
1.	6. Software version
	Not Applicable
1.	7. Affected serial or lot number range
	All Serial Numbers
1.	8. Associated devices

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	Not Applicable

2. Reason for Field Safety Corrective Action (FSCA)	
2.	1. Description of the product problem
	Beginning July 16, 2021, Exactech issued an Urgent Dear Healthcare Professional (DHCP) communication to surgeons globally for Exactech Connexion GXL liners that discussed the GXL liner's relatively high susceptibility to edge loading that could lead to early asymmetric polyethylene wear and periacetabular and proximal femoral osteolysis. Exactech is now updating this communication to include an additional risk factor that has been identified and to expand the scope of the affected patients. Exactech has identified an additional risk factor for premature wear that was not known at the time of the prior DHCP communication. GXL inserts manufactured since 2005 were packaged in out-of-specification (referred to hereafter as "non-conforming") vacuum bags that are oxygen resistant but do not contain a secondary oxygen barrier layer known as ethylene vinyl alcohol (EVOH), which further augments oxygen resistance. Exactech has also learned that additional conventional (i.e., non-crosslinked) ultra-high molecular weight polyethylene acetabular liners were packaged in non-conforming vacuum bags. These conventional liners are identified in Attachment 1. These polyethylene liners differ from Connexion GXL in that they are composed of conventional, non-crosslinked ultra-high molecular weight polyethylene (hereafter referred to as UHMWPE). augments oxygen resistance.
2.	2. Hazard giving rise to the FSCA
	Over the first 9 months of 2020 Exactech became aware of three journal articles that were either published or submitted for publication which identified a number of revisions due to excessive wear for GXL Liners. In the first quarter of 2021 Exactech had also become aware of a hospital facility that identified an increase in patients that are displaying signs of increased wear of GXL Liners In August 2021, we identified that the GXL liner packaging, did not comply with the established material specification. Specifically, the material certifications did not indicate the presence of Ethylene Vinyl Alcohol (EVOH) as a component of the bag construction for all lots received during this time period. After additional analysis, we have confirmed that our GXL inserts manufactured since 2005 were packaged in out-of-specification (referred to hereafter as "non-conforming") vacuum bags that are oxygen resistant but do not contain a secondary barrier layer containing ethylene vinyl alcohol (EVOH) that further augments oxygen resistance.

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	During the analysis of GXL in relation to the vacuum bag nonconformance, Exactech also reviewed data related to our conventional polyethylene acetabular liners. These liners are not crosslinked, and therefore is less susceptible to oxidation than the Connexion GXL polyethylene. While conventional polyethylene acetabular liners have not demonstrated clear safety signals or evidence of premature wear in either the published, peer-reviewed literature, or in Exactech internal clinical data, we do not have sufficient long-term clinical data on the performance of Exactech conventional polyethylene to determine whether the packaging non-conformity has affected its clinical performance. Given that some manufacturing lots of our conventional polyethylene were packaged in non-conforming bags, and the fact that this polyethylene is not antioxidant stabilized, (e.g., with vitamin E), conventional polyethylene devices in non-conforming packaging are included in the current recall / field action.
2.	3. Probability of problem arising
	Based upon Exactech's health hazard evaluation, the likelihood of this issue leading to harm is very low considering the number of variables that could contribute to excessive wear.
2.	4. Predicted risk to patient/users
	The use of these non-conforming bags may enable increased oxygen diffusion to the polyethylene insert resulting in increased oxidation of the material relative to inserts packaged with the specified additional oxygen barrier layer. Over time, oxidation can severely degrade the mechanical properties of the polyethylene, which, in conjunction with other surgical factors, can lead to both accelerated wear and bone loss, and/or component fatigue cracking/fracture, all leading to corrective revision surgery.
2.	5. Further information to help characterise the problem
	Reference the attached Dear Healthcare Professional Letter (DHCP), Patient Letter and the Frequently Asked Questions (FAQ).
2.	6. Background on Issue
	See Section 2
2.	7. Other information relevant to FSCA
	None

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	3. Type of Action to mitigate the risk	
3.	**1. Action To Be Taken by the User** ☒ Identify Device ☒ Quarantine Device ☒ Return Device ☐ Destroy Device ☐ On-site device modification/inspection ☒ Follow patient management recommendations. Please see attached DHCP Letter. ☐ Take note of amendment/reinforcement of Instructions For Use (IFU) ☐ Other ☐ None Please see attached DHCP Letter.	
3.	2. By when the action should be completed?	Product Removal: As soon as possible, but no later than 15 September 2022. DHCP Communication: As soon as possible, but no later than 15 September 2022
3.	3. Particular considerations for: Implantable device Is follow-up of patients or review of patients' previous results recommended? **Yes** – Please see attached DHCP Letter	
3.	4. Is customer Reply Required?	Yes
3.	**5. Action Being Taken by the Manufacturer** ☒ Product Removal ☐ On-site device modification/inspection ☐ Software upgrade ☐ IFU or labelling change ☒ Other ☐ None Sending DHCP Letter to Surgeons that have implanted affected product	
3	6. By when should the action be completed?	All Actions (FSCA Termination): 12/31/2022
3.	7. Is the FSN required to be communicated to the patient / lay user?	No
3	8. If yes, has manufacturer provided additional information suitable for the patient/lay user in a patient/lay or non-professional user information letter/sheet?	

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	The FSN itself does not need to be forwarded to patients/lay users; however, Exactech has provided a Patient Letter Template to assist surgeons in communicating with their patients regarding this issue. It is up to the surgeon or the health professional to consider the modalities of information for patients wearing these implants.

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	4. General Information	
4.	1. FSN Type	Update
4.	2. For updated FSN, reference number and date of previous FSN	Ref: 2021-01-29-03 08/26/2021
4.	**3.** For Updated FSN, key new information as follows:	

1. Exactech will be removing all remaining GXL Acetabular Liners, and all conventional hip polyethylene acetabular liners packaged in nonconforming vacuum bags, globally.
2. The purpose of the current letter is to update surgeons regarding the implications of the packaging non-conformity on performance of the Connexion GXL and other conventional UHMWPE acetabular liners. In addition, this letter provides updates to patient management and follow-up recommendations since issuance of the July 2021 DHCP letter.

The previous DHCP outlined the following recommendations for patient management:
"Exactech's recommendation for surgeons is that Connexion GXL patients who are less than six (6) years from index surgery and who have not been seen in over 12 months return to the office/clinic for a routine clinical exam and x-rays, including standing AP pelvis, cross-table lateral, and sitting/functional lateral. These x-rays will assess the relative alignment of the acetabular and femoral components and should identify edge loading. For patients with edge loading components, early asymmetric polyethylene wear, and early signs of lysis, the surgeon should consider revising the patient's acetabular construct (i.e., Connexion GXL liner and potentially the acetabular shell) based on the surgeon's judgement."

Please make note of the following updates for patient management outlined in this updated letter:

a. Exactech is expanding the scope of the recall DHCP communication to include all surgeons who have implanted either GXL liners or nonconforming conventional UHMWPE liners since 2004. The previous letter included only surgeons that had implanted Connexion GXL liners between 2015 and 2021.
b. Exactech is expanding the patient follow-up guidance to include all patients who have received a:
    i. GXL liner regardless of packaging materials and have not been examined in the past 12 months.

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	ii. Conventional UHMWPE acetabular liners packaged in nonconforming packaging and have not been examined in the past 12 months.	
4.	4. Further advice or information already expected in follow-up FSN?	No
4	5. If follow-up FSN expected, what is the further advice expected to relate to:	
	Not Applicable.	
4	6. Anticipated timescale for follow-up FSN	Not Applicable
4.	7. Manufacturer information (For contact details of local representative refer to page 1 of this FSN)	
	a. Company Name	Exactech, Inc.
	b. Address	2320 NW 66th Court, Gainesville, FL 32653
	c. Website address	www.exac.com
4.	8. The Competent (Regulatory) Authority of your country has been informed about this communication to customers.	
4.	9. List of attachments/appendices:	See Attached: • Attachment 1 – Product Details • DHCP Letter • Patient Letter Template • Frequently Asked Questions
4.	10. Name/Signature	[redacted] Director Quality Management Systems & Compliance Signature

	Transmission of this Field Safety Notice
	This notice needs to be passed on all those who need to be aware within your organisation or to any organisation where the potentially affected devices have been transferred. (As appropriate) Please transfer this notice to other organisations on which this action has an impact. (As appropriate)

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	Please maintain awareness on this notice and resulting action for an appropriate period to ensure effectiveness of the corrective action. Please report all device-related incidents to the manufacturer, distributor or local representative, and the national Competent Authority if appropriate, as this provides important feedback.

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Distributor/Importer Reply Form

1. Field Safety Notice Information	
Correction Notice Ref. no.:	2021-01-29-03
Correction Notice Date:	26:08:2021
Product/ Device name	EXACTECH GXL LINERS FOR NOVATION, ACUMATCH, AND MCS SYSTEMS
Product Code(s)	See Attachment 1
Batch/Serial Number (s)	All Serial Numbers

2. Distributor/Importer Details	
Company Name	Exactech France
Address	Parc Ariane Basement 2 42 avenue Ariane 33700 Mérignac, France
Contact Name	[redacted]
Title or Function	Country Analyst
Telephone number	+33564371560
Email	[redacted]

1. Return acknowledgement to Sender	
Email	recalls@exac.com
Distributor/Importer Helpline	+1 800-392-2832
Postal Address	2320 NW 66th Court, Gainesville, FL 32653 USA
Web Portal	www.exac.com
Deadline for returning the Distributor/Importer reply form*	Within 15 business days of receipt of Field Safety Notice.

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2. Distributors/Importers (check all that apply)		
☐	I confirm the receipt, the reading and understanding of the Field Safety Notice.	
☐	I have identified customers that received or may have received this device.	
☐	I have informed the identified customers of this Field Safety Notice and that they are required to follow up with any patients who have had the affected devices implanted.	☐ YES, Date of communication: ☐ No, Please explain:
Print Name		
Signature		
Date		

It is important that your organization confirms that you have received the Field Safety Notice and takes the actions detailed in this Field Safety Notice.

Your organization's reply is the evidence we need to monitor the progress of the proposed actions.

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URGENT DEAR HEALTHCARE PROFESSIONAL COMMUNICATION

4th October 2022

To: Surgeons, Hospitals, Health care professionals
Description: Exactech moderately crosslinked and conventional UHMWPE Acetabular Hip Liners (CONNEXION GXL, ACUMATCH, MCS and NOVATION)

Product specific information is listed in Attachment 1

Dear Surgeon:

In July 2021, Exactech issued a worldwide Urgent Dear Healthcare Professional (DHCP) communication regarding Exactech Connexion GXL, moderately crosslinked polyethylene acetabular hip liners (link to Exactech website: https://de.exac.com/rueckrufinformationen/). The purpose of the July 2021 communication was to inform surgeons that Exactech had observed a higher-than-expected number of cases in which the Connexion GXL liner exhibited early linear and volumetric wear with associated periacetabular and proximal femoral osteolysis. Exactech also characterized some of the risk factors that were associated with early polyethylene wear, including the following:

1. Use of the thinnest available liner for a given acetabular shell (e.g., a 36mm inner diameter liner in a 52mm outer diameter acetabular shell)
2. A lateralized (+5mm) or face-changing liner.
3. Implantation of the femoral and acetabular components in such a way that edge loading between the femoral head and acetabular liner was occurring.

Exactech has identified an additional risk factor for premature wear that was not known at the time of the prior DHCP communication. GXL inserts manufactured since 2004 were packaged in out-of-specification (referred to hereafter as "non-conforming") vacuum bags that are oxygen resistant but do not contain a secondary oxygen barrier layer known as ethylene vinyl alcohol (EVOH), which further augments oxygen resistance. **The use of these non-conforming bags may enable increased oxygen diffusion to the polyethylene insert resulting in increased oxidation of the material relative to inserts packaged with the specified additional oxygen barrier layer. Over time, oxidation can severely degrade the mechanical properties of the Connexion GXL polyethylene, which, in conjunction with other surgical factors, can lead to both accelerated wear and bone loss, and/or component fatigue cracking/fracture, all leading to corrective revision surgery.**

Since issuance of the July 2021 communication, Exactech has also learned that additional conventional (i.e., non-crosslinked) ultra-high molecular weight polyethylene acetabular liners were packaged in non-conforming vacuum bags. These conventional liners are identified in Attachment 1. These polyethylene liners differ from Connexion GXL in that they are composed of conventional, non-crosslinked ultra-high molecular weight polyethylene (hereafter referred to as UHMWPE). Like the Connexion GXL, these liners are susceptible to increased oxygen diffusion during shelf storage, with subsequent risks for component fatigue and damage after implantation.

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The purpose of the current letter is to update surgeons regarding the implications of the packaging non-conformity on performance of the Connexion GXL and other conventional UHMWPE acetabular liners. In addition, this letter provides updates to patient management and follow-up recommendations since issuance of the July 2021 DHCP letter. (link to Exactech website for initial DHCP letter: de.exac.com/rueckrufinformationen). Please make note of the following updates:

1. We are expanding the scope of the recall communication to include all surgeons who have implanted either GXL liners or nonconforming conventional UHMWPE liners since 2004. The previous letter included only surgeons that had implanted Connexion GXL liners between 2015 and 2021.
2. We are expanding the patient follow-up guidance to include all patients who have received either a:
    a. GXL liner regardless of packaging materials and have not been examined in the past 12 months.
    b. Conventional UHMWPE acetabular liners packaged in nonconforming packaging and have not been examined in the past 12 months.
3. Patient management instructions, including X-rays and other diagnostic workup instructions, remain the same as identified in the prior letter.
4. This communication relates ONLY to Exactech Connexion GXL, and conventional UHMWPE acetabular liners sold in the OUS. Exactech's highly crosslinked, vitamin E infused polyethylene liner, known as Alteon® XLE Liner, is not affected by this recall.

Background and synthesis of worldwide clinical data regarding Exactech Connexion GXL and conventional hip polyethylene:

Over the past ~20 years, Exactech has marketed and sold two varieties of hip polyethylene that are affected by this recall: 1) Conventional UHMWPE, 2) Connexion GXL moderately cross-linked polyethylene:

1. **Connexion GXL** liner was first released for broad commercialization in 2005. This acetabular insert is the only Exactech product that is manufactured using a "moderate" cross linking process (i.e., two split doses of 25 kGy of gamma irradiation). This process was initially designed to optimize the mechanical properties of fracture resistance with the crosslinking benefits of reduced polyethylene wear. Our analysis shows that this moderately cross-linked material, which is unique to the Connexion GXL liner, is inherently more susceptible to oxidation and polyethylene wear in the hip versus modern, highly crosslinked Vitamin E polyethylene liners. This susceptibility is heightened when it is packaged in non-conforming bags, which allow increased oxygen diffusion.

    Published worldwide registry data on the Connexion GXL acetabular liner (e.g., United Kingdom and Australian joint registries) contain insufficient sample sizes to enable any conclusions regarding clinical performance. However, Exactech is aware of three peer-reviewed publications regarding early wear and osteolysis of the Connexion GXL liner. These publications have helped Exactech elucidate which Connexion GXL patients are at risk for early failures [1], [2], [3].
    These articles have collectively identified 19 patients that experienced medium-term failure of Connexion GXL liners. The failure rates of the Connexion GXL liner in these series range from 1%-3.2% at ~ 5 years. The articles propose that surveillance of Connexion GXL patients is warranted. The average time to revision in these three papers was ~ 5 years. While it appears that most patients with

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premature wear have symptoms of hip and / or groin pain, we have also observed that premature wear and lysis can occur in asymptomatic patients.

2. **Exactech conventional polyethylene.** Unlike the GXL liner, evidence of premature wear in the conventional polyethylene liners was not identified in literature or registries at the time of this recall. However, the effects of the non-conforming packaging on the conventional polyethylene liner are not fully known due to insufficient long-term clinical data. Given that some manufacturing lots of our conventional polyethylene were packaged in non-conforming bags, and the fact that this polyethylene is not antioxidant stabilized, (e.g., with vitamin E), conventional polyethylene devices in non-conforming packaging are included in the current recall / field action.

RECOMMENDATIONS REGARDING PATIENT FOLLOW-UP AND MANAGEMENT:

Exactech recommends that surgeons closely monitor the affected GXL and conventional polyethylene patients for early wear and / or early signs of lysis:

- For GXL, regardless of packaging materials and regardless of the time period that has elapsed since index arthroplasty.
- For conventional polyethylene, in non-conforming packaging and regardless of the time period that has elapsed since index arthroplasty.

Exactech also recommends that surgeons perform follow-up examination on all affected GXL and conventional polyethylene patients who have not been seen in over 12 months. Suggested follow-up includes a routine clinical hip exam and x-rays, including standing AP pelvis, cross-table lateral, and sitting/functional lateral. These x-rays will assess the relative alignment of the acetabular and femoral components and should identify edge loading. Additional three-dimensional imaging (i.e., computed tomography or magnetic resonance imaging) should also be utilized by surgeons to better characterize lytic defects, based on the surgeon's discretion. Other diagnostic workup for failed total hip arthroplasty, including serology and hip aspiration should also be used at the surgeon's discretion. **Pre-emptive removal of non-painful, well-functioning Exactech hip devices from asymptomatic patients is not recommended**. Decisions about removing or exchanging the device should be made by health care providers in consultation with the patient or caregiver on a case-by-case basis. As part of shared decision-making, discuss the benefits and risks of all relevant treatment options with your patients. For patients who exhibit premature polyethylene wear, the surgeon should consider revision surgery per their clinical judgment. If the surgeon desires to perform an isolated polyethylene exchange, Exactech can provide new Vitamin E infused (XLE liner) polyethylene hip inserts, for AcuMatch and Novation acetabular liners only. The surgeon should also use his/her discretion to determine whether revision of the entire acetabular construct (i.e., outer metal shell and polyethylene liner) is warranted.

In addition to providing surgeons with lists of all their affected GXL and/or conventional polyethylene patients since 2004, Exactech is providing surgeons with two draft letters directed at patients who have been implanted with Exactech GXL hip devices. We recommend that surgeons customize the letter and send it to patients. Alternatively, Exactech is prepared to send these letters to your patients or provide administrative assistance with these mailings. We may contact you separately about your willingness to participate in a voluntary program to provide Exactech with statistics on patient follow-up per a new FDA Patient Science and Engagement Program. Exactech is also prepared to provide you (1) a list of all your patients' identification to assist in clinical follow-up efforts, (2) a frequently asked questions page online to assist you, and (3) a tool on Exactech's website

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that will empower a patient to enter her/his implant serial number and confirm whether that implanted device is non-conforming.

Exactech is advising surgeons to avoid implanting nonconforming devices. A list of product codes, product description and serial numbers can be found at: https://de.exac.com/rueckrufinformationen/. Your Exactech agent will work with you to remove non-conforming devices from inventory.

Exactech is committed to reimbursing your patients for their out-of-pocket expenses associated with the recall and have engaged a third-party administrator, Broadspire, to process these claims. Additionally, Exactech has engaged orthopedic nurses who can answer live questions from patients regarding the GXL and/or conventional liners and premature wear. Information regarding these services can be found on the Exactech website at: https://de.exac.com/rueckrufinformationen/.

If it is helpful, we would appreciate the opportunity to set up a conference call / WebEx with you and our corporate leadership team to discuss the issues around this recall, the TPA services, provision of patient lists and management, drafted letters to patients, or any other questions in greater detail. Please correspond with the email address, gxl@exac.com, if you wish to meet and we will arrange a time as soon as possible.

Actions to be Taken:

- **Review this communication thoroughly.**
- **Contact your local Exactech Representative** if you have any questions regarding this communication.
- **Provide letters to your patients informing them of the issue and to return for observation if not seen in the past 12 months. Exactech can assist you with these communications.**
- **Your local agent will help to determine which liners are affected and should be removed from inventory.**

Our first concern is for the health and safety of patients and the users of our products. Actions of this type are collaborative efforts and require your participation to be effective.

Sincerely,

[redacted]
Chief Medical Officer
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References:

1. Early Polyethylene Failure in a Modern Total Hip Prosthesis: A Note of Caution; Thomas, Parvataneni, Vlasak, and Gray; The Journal of Arthroplasty, 35, 2020, 1297-11302
2. Early Failure of Modern Moderately Cross-Linked Polyethylene Acetabular Liner; Kahlenberg, Menken, Ranawat, and Rodriguez; Arthroplasty Today, 6, 2020, 224-226
3. Unexpected Wear of a Moderately Crosslinked Polyethylene in Total Hip Arthropolasty; Yakkanti, Ocksrider, Patel, Kolevar, Moore, Rimnac, Kraay, Wright, Baral, Robinson; Abstract for AAOS (future publication)

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ATTACHMENT 1
Product Information:

Product Line Number	Product Line Description
130-28-51	NV GXL LINR, NTRL, 28MM ID, GROUP 1 CUPS
130-28-52	NV GXL LNR, NEUTRAL, 28MM ID, GROUP 2 CUPS
130-32-51	NV GXL LINER NEUTRAL, 32MM ID GROUP 1 CUPS
130-32-52	NV GXL LINR, NTRL, 32MM ID, GROUP 2 CUPS
130-32-53	NV GXL LNR, NEUTRAL, 32MM ID, GROUP 3 CUPS
130-32-54	NV GXL LNR, NEUTRAL, 32MM ID, GROUP 4 CUPS
130-32-55	NV GXL LNR, NEUTRAL, 32MM ID, GROUP 5 CUPS
130-36-52	NV GXL LINER NEUTRAL, 36MM ID, GROUP 2 CUPS
130-36-53	NV GXL LINR, NTRL, 36MM ID, GROUP 3 CUPS
130-36-54	NV GXL LINR, NTRL, 36MM ID, GROUP 4 CUPS
130-36-55	NV GXL LINR, NTRL, 36MM ID, GROUP 5 CUPS
132-32-51	NV GXL LINER LIPPED 32MM ID, GROUP 1 CUPS
132-32-52	NV GXL LNR, LIPPED 32MM ID GROUP 2 CUPS
132-32-53	NV GXL LNR, LIPPED, 32MM ID, GROUP 3 CUPS
132-36-52	NV GXL LINER LIPPED 36MM ID GROUP 2
132-36-53	NV GXL LNR, LIPPED, 36MM ID, GROUP 3 CUPS
134-36-43	NV CNSTR LINER 36MM ID GROUP 3
136-32-51	NV GXL LNR, +5LAT, 32MM G1-48/50MM CUPS
136-32-52	NV GXL LNR, +5LAT, 32MM G2-52/54MM CUPS
136-32-53	NV GXL LNR, +5 LAT 32MM ID, GROUP 3 CUPS
136-32-54	NV GXL LNR, +5 LAT 32MM ID, GROUP 4 CUPS
136-32-55	NV GXL LNR, +5 LAT 32MM ID, GROUP 5 CUPS
136-36-52	NV GXL LNR, +5LAT, 36MM G2-52/54MM CUPS
136-36-53	NV GXL LNR, +5LAT, 36MM G3-56/58MM CUPS
136-36-54	NV GXL LNR, +5LAT, 36MM G4-60/62MM CUPS
136-36-55	NV GXL LNR, +5LAT, 36MM G5-64/66/68MM CUPS
138-32-51	NV GXL LNR, 10 DEG FACE, 32MM ID, GRP 1 CUP
138-36-52	NV GXL LNR, 10 DEG FACE, 36MM ID, GRP 2 CUP
138-36-53	NV GXL LNR, 10 DEG FACE, 36MM ID, GRP 3 CUP
138-36-54	NV GXL LNR, 10 DEG FACE, 36MM ID, GRP 4 CUP
138-36-55	NV GXL LNR, 10 DEG FACE, 36MM ID, GRP 5 CUP

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FIELD SAFETY NOTIFICATION

20 August 2021

To: Surgeons, Hospitals, Health care professionals
Description: Exactech Connexion GXL acetabular polyethylene liners

Section 1- Introduction

Dear Surgeon:

The purpose of this letter is to inform you of recent observations made by Exactech regarding the clinical performance of the Connexion GXL acetabular liner. This communication relates to all Exactech Connexion GXL liners. The product specific information is listed in Table 1 below.

It is the practice of Exactech to perform detailed analysis and inform our surgeon customers and patients as soon as possible when such observations are made.

- During the past ~24 months, Exactech has observed that in a small percentage of patients (.118%) who are between 3-6 years from index total hip arthroplasty, the Connexion GXL liner exhibits early linear and volumetric wear.
- In some of these patients, wear has led to proximal femoral and acetabular osteolysis.
- This phenomenon appears to occur when the relative implant position of the acetabular and femoral components in either/both the coronal plane and the sagittal plane results in edge loading of the femoral head on the liner.
- This phenomenon appears to be more common in direct anterior (DA) hip approaches.
- This phenomenon appears to be more common in patients with higher activity levels[1].
- The phenomenon appears to be more common and more pronounced in patients who have been implanted with larger femoral heads (e.g. 36mm), and in which the thinnest available acetabular liner was used (e.g., a 36mm CoCr head used in 52mm acetabular socket).
- In patients where the femoral head is articulating orthogonally to the acetabular component in the functional pelvic position (i.e. edge loading is not occurring), this wear phenomenon does not appear to occur.

Exactech's recommendation for surgeons is that Connexion GXL patients who are less than six (6) years from index surgery and who have not been seen in over 12 months return to the office/clinic for a routine clinical exam and x-rays, including standing AP pelvis, cross-table lateral, and sitting/functional lateral. These x-rays will assess the relative alignment of the acetabular and femoral components and should identify edge loading. For patients with edge loading components, early asymmetric polyethylene wear, and early signs of lysis, the surgeon should consider revising the patient's acetabular construct (i.e. the Connexion GXL liner and potentially the acetabular shell) based on the surgeon's judgment. .

Actions to be Taken:

- **Review this communication thoroughly.**
- **Contact your local Exactech Representative** if you have any questions regarding this communication.

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Table 1: Product Information:

Catalog Number	Description	Catalog Number	Description
104-28-XX	MCS +5GXL LINER 5/15 DEG	**132-36-XX**	Acumatch GXL 15 Degree Liner, 36mm
	MCS GXL LINER 5/15 DEG		Novation GXL Liner, Lipped Ant, 36mm
104-32-XX	MCS +5GXL LINER 5/15 DEG		Novation GXL Liner, Lipped, 36mm
	MCS GXL LINER 5/15 DEG	**132-40-XX**	Novation GXL Liner, Lipped Ant, 40mm
104-36-XX	MCS +5GXL LINER 5/15 DEG		Novation GXL Liner, Lipped, 40mm
	MCS GXL LINER 5/15 DEG	**134-28-XX**	Acumatch GXL, Ext Cov Liner, 28mm
130-22-XX	Novation GXL Neutral Liner, G00, 22mm ID	**136-22-XX**	Novation GXL Liner, +5mm Lateralized, G00, 22mm ID
130-28-XX	Acumatch GXL 0 Degree Liner, 28mm	**136-28-XX**	Novation GXL Liner, +5mm Lateralized, 28mm
	Novation GXL Liner, Neutral, 28mm		Novation GXL Liner, +5mm Lateralized, G0, 22mm ID
	Novation GXL Neutral Liner, G0, 28mm ID	**136-32-XX**	Novation GXL Liner, +5mm Lateralized, 32mm
130-32-XX	Acumatch GXL 0 Degree Liner, 32mm	**136-36-XX**	Novation GXL Liner, +5mm Lateralized, 36mm
	Novation GXL Liner, Neutral, 32mm	**136-40-XX**	Novation GXL Liner, +5mm Lateralized, 40mm
130-36-XX	Acumatch GXL 0 Degree Liner, 36mm	**138-22-XX**	Novation GXL 10 deg Liner, G00, 22mm ID
	Novation GXL Liner, Neutral, 36mm	**138-28-XX**	Acumatch GXL 15 Degree, +5 Lat Liner, 28mm
130-40-XX	Novation GXL Liner, Neutral, 40mm		Novation GXL 10 Deg Liner, G0, 28mm ID
132-22-XX	Novation GXL Liner, G00, 22mm ID		Novation GXL Liner, 10 Deg Face, 28mm
	Novation GXL Liner, Lipped Ant, 28mm	**138-32-XX**	Novation GXL Liner, 10 Deg Face, 32mm
132-28-XX	Acumatch GXL 15 Degree Liner, 28mm	[redacted]	
	Novation GXL Liner, G0, 28mm ID		
	Novation GXL Liner, Lipped Ant, 28mm		
	Novation GXL Liner, Lipped, 28mm		
132-32-XX	Acumatch GXL 15 Degree Liner, 32mm		
	Novation GXL Liner, Lipped Ant, 32mm		
	Novation GXL Liner, Lipped, 31mm		

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Catalog Number	Description	Catalog Number	Description
	Novation GXL Liner, Lipped, 32mm	[redacted]	

Our first concern is for the health and safety of patients and the users of our products. Actions of this type are collaborative efforts and require your participation to be effective.

Sincerely,

[redacted]
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Section 2 - Synthesis of worldwide clinical data regarding Exactech Connexion GXL

Since 2008, 89,050 Connexion GXL liners have been implanted worldwide (as of April 2021). Exactech has maintained and monitored several data sources to document the clinical track record of the Connexion GXL liner. A review of all available data sources as of May 3rd, 2021, reveals 105 total complaints related to liner wear (overall complaint rate of 0.118% since 2008). Within this group of 105 complaints, there have been 90 worldwide known revisions for wear-related issues (wear-related revision rate of 0.101%). Kaplan-Meier survivorship analysis suggests that ~ 1% of liners will fail at eight years due to polyethylene wear.

The most common implant characteristics associated with increased risk of wear-related revision include:

1. A lateralized (+5mm) or face-changing liner – **this group has a ~2.5x increased risk of revision**
2. Use of the thinnest liner (i.e., the largest available femoral head is used with the implanted acetabular shell) – **this group has ~2.0x increased risk of revision**
3. When these implant factors are combined with an edge loading environment, the risk of premature wear further increases.

It is relevant that complaint rates of the Connexion GXL liner vary significantly between institutions and even within countries. For example, both the United States (0.521%) and Germany (0.828%) have higher complaint rates than the overall complaint rate. Additionally, some institutions have reported failure rates as high as 3.2% [1], with others reporting rates as low as 0.1% for wear-related issues [Exactech clinical data]. In those series with the highest revision rates, 78% of revised cases have used the thinnest available liner (#2 above).

It is also important to note that since 2007, Exactech has conducted an ongoing, large scale clinical study of the Connexion GXL liner that includes 1,394 patients. This post-market clinical follow-up (PMCF) study comprises 22 surgeons from 12 different sites. This actively and regularly monitored patient group has demonstrated a total of three revisions (0.21%) for liner wear issues.

In summary, the overall currently known, wear-related failure rate for ~90,000 implanted devices is 0.115%. The survivorship rate of the Connexion GXL liner is within registry standards for safe devices. Exactech's regularly monitored PMCF database of 1,394 patients demonstrates a 0.21% revision rate for polyethylene wear and lysis.

Section 3 – Synthesis, conclusions, and Exactech recommendations and support for surgeons

1. Like all implant companies, Exactech is constantly innovating and improving implants.
2. The Connexion GXL resulted from the careful analysis of the state-of-the-art THA bearing technology when it was developed in ~2007.
3. Moderate crosslinking was considered safe at that time and is protective against liner fracture.
4. Connexion GXL has robust wear resistance and fracture resistance properties as evidenced by bench testing and large long-term clinical follow-up series.
5. Individual institutional series have demonstrated that a small percentage of patients have significant lysis and wear with Connexion GXL liner; the highest reported single institution wear-related failure rate is 3.2%
6. Cup position on AP x-rays is not predictive of wear.
7. The phenomenon of significant wear and lysis is multifactorial in those patients who exhibit it.
8. The Connexion GXL liner is inherently susceptible to edge loading differently than HXLPE. Connexion GXL tends to exhibit accelerated linear and volumetric wear when edge loaded (as opposed to breaking or dissociating).

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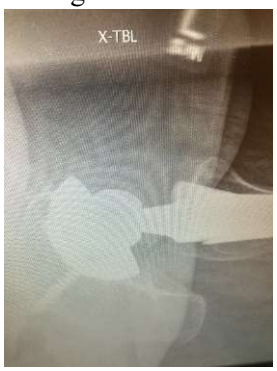
9. When the combined anteversion and/or combined abduction of the acetabular and femoral components is high, edge loading and accelerated wear can present
10. Individual patient biologic, immunologic response is also an important determinant of osteolysis
11. Exactech recommends regular follow-up on patients with Connexion GXL liners who are < 6 years from index THA.
12. For patients < 6 yrs. from index THA who have not been seen in > 12 months, recommend follow-up:
    a. AP pelvis x-ray
    b. Cross-table lateral x-ray
    c. Functional sitting and standing x-rays, if possible
13. For patients with x-ray signs of either:
    a. Edge loading (by x-ray)
    b. Early lysis
    c. Exactech recommends either repeat follow-up in 6-12 months, CT scan imaging (if considered clinically necessary to assess lytic lesions), and potentially revision, based on the surgeon's judgment.
14. Finally, Exactech encourages surgeons who receive this letter to inform Exactech as soon as possible if they are aware of Connexion GXL failures in their own personal series that have not been previously reported.

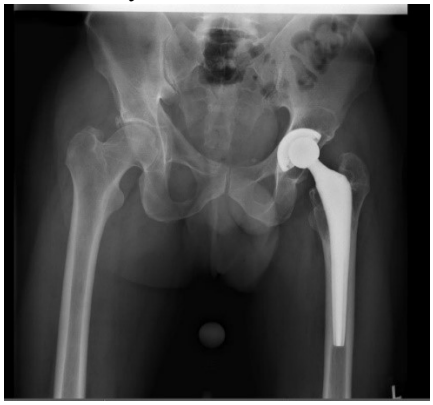
Appendix:

X-ray image examples of Connexion GXL liner cases exhibiting early failure:

1. Significant combined anteversion with anterior edge loading of the femoral head on the acetabular liner



2. Osteolysis, radiolucencies, and/or asymmetric wear



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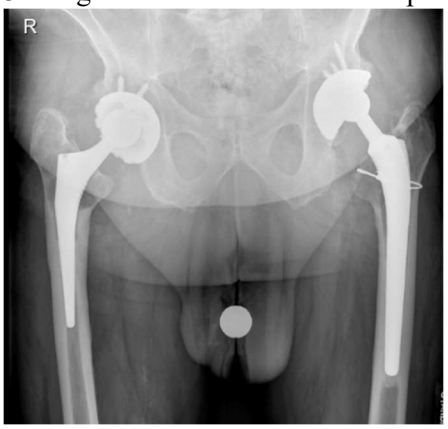
3. Significant vertical/abduction positioning of the acetabular component



Background/history of UHMWPE and XLPE in hip/knee arthroplasty and design rationale of Exactech Connexion GXL acetabular liner

The R&D work that led to the development of the Exactech Connexion GXL liner was completed between 2005-2008. The Connexion GXL liner was first released for broad commercialization in 2008.

Between the years of ~1999-2005, HXLPE was first introduced to the market by several companies. During these early years of HXLPE usage, numerous reports of HXLPE mechanical failures were reported (Zimmer Longevity HXLPE acetabular liner, the Zimmer Prolong knee polyethylene, and the DePuy Pinnacle HXLPE liner) [2]–[8]. It was not as clear in the early 2000's as it is today that HXLPE and Vitamin E antioxidant infused liners would be safe and would exhibit sufficient fracture resistance[9], [10].

Therefore, Exactech (similar to other companies), conducted extensive research and development activity to produce the "moderately" crosslinked Connexion GXL liner that attempts to optimize mechanical properties of fracture resistance with the crosslinking benefits of reduced polyethylene wear. Hip simulation studies have long shown that gamma radiation in the range of 50-100kGy can reduce abrasive wear in polyethylene[10], [11].

This type of data was used to develop the Connexion GXL manufacturing process, in which compression molded UHMWPE undergoes two precision split-doses of 25kGy irradiation for a total of 50kGy. Bench testing demonstrated that the Connexion GXL liner exhibits a 59% reduction in wear and excellent performance in three-point bending testing (i.e. fracture resistance). As of April 2021, nearly 90,000 Connexion GXL liners have been implanted globally, and Exactech has not had any reports of liner fracture and/or catastrophic liner dissociation.
It is important to note that similar to other moderately crosslinked liners, recent bench testing of the Connexion GXL liner has substantiated our clinical experience by demonstrating that it can wear at a faster rate when placed in an environment of anterior edge loading and posterior impingement (as is often seen with anterior approaches). In many reported cases of Connexion GXL liner wear and osteolysis, it is noted that either the combined anteversion or combined abduction of the components results in edge loading of the Connexion GXL liner. In cases where edge loading is not occurring, accelerated wear does not appear to occur.

Synthesis of recent peer-reviewed published data regarding Exactech Connexion GXL acetabular liner

Since 2019, three peer-reviewed publications have been produced regarding early wear and osteolysis with the Connexion GXL liner. These publications have helped Exactech elucidate which Connexion GXL patients are at risk for early failures[1], [12], [13].

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These articles have identified a total of 19 patients that experienced of medium-term failure of Connexion GXL liners. The failure rates of the Connexion GXL liner in these series range from 1%-3.2% at ~ 5 years. The articles propose that surveillance of Connexion GXL patients is warranted. The average time to revision in these three papers was ~ 5 years. In addition, Exactech's deeper analysis of these 19 cases has revealed what has been described above – the highest risk patients for wear-related failure are those with the thinnest polyethylene liners.
Additionally, in these series was a tendency for early and accelerated wear to be demonstrated in patients who had cup positions toward cups at upper ends of Lewinnek abduction/anteversion, and a tendency towards younger, (<70 yrs.) more active patients. Of note, these papers did not measure the functional pelvic position of the acetabular components. These papers used the Lewinnek safe zone concept on static x-rays to determine the relative appropriateness of cup position[1], [12], [13].

It is well understood that Lewinnek safe zones have relatively limited clinical utility. Rather, a patient's sitting and standing functional pelvic position is more predictive of hip stability and edge loading [14]–[17].
It is also noted that the index THA in many of the patients in these series was performed through a direct anterior approach. It has been reported that the direct anterior approach to the hip can lead to supranormal combined anteversion of the acetabular and femoral components with subsequent anterior edge loading[16], [18], [19].

Finally, it is also important to note that the immunologic response to wear debris is highly variable between patients [20], [21]. Therefore, it is likely that a subset of patients who have significant biologic and immunologic response to wear debris are at greater risk for early osteolysis.

In summary, these published articles have helped identify risk factors early wear and lysis in patients who have been implanted with a Connexion GXL liner. [18], [19].

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